

WHAT IS CLAIMED IS:

Claim 1: A system for the thermolytic eradication of bacteria and biofilm in the root canal of a human tooth, said system comprising an elongated and flexible optical probe, a laser oscillator communicating with the distal end of said optical probe through at least one optical fiber, a power supply operatively connected to said laser oscillator, and a control operatively connected to said power supply and said laser oscillator;

(a) said optical probe being composed of a member of the class consisting of sapphire and zirconium, and having an optically diffusive surface dispersing optical energy throughout 360° laterally of said optical probe and along the entire length of said optical probe;

(b) said optical fiber ranging in diameter between 400 to 1000  $\mu$ ;

(c) said optical probe ranging in diameter from ISO 20 to ISO 70;

(d) said laser oscillator generating radiation in the low infrared wavelength range of 700 nm to 1100 nm;

(e) said optical fiber being operatively connected between said laser oscillator and an ingress at the proximal end of said optical probe;

(f) said optical probe being sufficiently long for insertion into substantially the entire length of the root canal of said tooth;

(g) said optical probe causing lateral dispersion of said radiation from said probe throughout said root canal;

(h) said control energizing said laser oscillator for dispersion of said

radiation at an energy density and for a period of time that are necessary to destroy said bacteria in said root canal.

Claim 2: The system of claim 1 wherein said period of time is sufficient to destroy pathogenic microorganisms in said root canal.

Claim 3: The system of claim 1 wherein said laser oscillator is a diode and said radiation is continuous mode radiation.

Claim 4: The system of claim 1 wherein said laser oscillator is a diode and said radiation is gated continuous mode radiation.

Claim 5: The system of claim 1 wherein said laser oscillator is a Nd:YAG laser and said radiation is free running pulsed mode radiation.

Claim 6: A process for treatment of the root canal of a human tooth, said process comprising:

- (a) preliminary removal of bacteria and biofilm from the entire elongated space of said root canal;
- (b) debridement of said entire elongated space;
- (c) insertion of an elongated optical probe into said entire elongated space;
- (d) transmission of low infrared radiation longitudinally into the entire length of said optical probe and laterally through the surface of said elongated probe to the surface of said root canal defining said space, and through the dentinals adjoining said root canal;
- (e) said transmission being of sufficient energy density and sufficient time duration to destroy remnants of said bacteria and biofilm in and adjacent to said root canal; and

(g) obturation of said space with an apical seal.

Claim 7: The process of claim 6 wherein said optical probe is composed of a member of the class consisting of sapphire and zirconium.

Claim 8: The process of claim 6 wherein said optical probe has an optically diffusive surface dispersing optical energy throughout 360° laterally of said optical probe and along the entire length of said optical probe.

Claim 9: The process of claim 6 wherein said radiation is transmitted from said laser to said probe via at least one optical fiber ranging in diameter between 400 to 1000  $\mu$ .

Claim 10: The process of claim 6 wherein said optical probe ranges in diameter from ISO 20 to ISO 70.

Claim 11: The process of claim 6 wherein said laser oscillator generates radiation in the low infrared wavelength range of 700 nm to 1100 nm.

Claim 12: A process for treatment of an infection in the root canal of a human tooth, said process comprising:

- (a) mechanical and chemical removal of bacteria and biofilm from the elongated space of said root canal;
- (b) mechanical shaping of said elongated space;
- (c) insertion of an elongated optical probe into said elongated space;
- (d) transmission of low infrared radiation longitudinally into the entire length of said optical probe and laterally through the surface of said elongated probe to the surface of said root canal defining said space;
- (e) said transmission being of sufficient energy density and sufficient time

duration to destroy remnants of said bacteria and biofilm in and adjacent to said root canal; and

(f) obturation of said space with an apical seal.

(g) said optical probe being composed of a member of the class consisting of sapphire and zirconium;

(h) said optical probe having an optically diffusive surface dispersing optical energy throughout 360° laterally of said optical probe and along substantially the entire length of said optical probe;

(i) said radiation being transmitted from said laser to said probe via at least one optical fiber ranging in diameter between 400 to 1000  $\mu$ ;

(j) said optical probe ranging in diameter from ISO 20 to ISO 70;

(k) said laser oscillator generating radiation in the low infrared wavelength range of 700 nm to 1100 nm.

13. The process of claim 12 wherein the infection includes *Fusobacterium*,

14. The process of claim 12 wherein the infection includes

*Peptostreptococcus*.

15. The process of claim 12 wherein the infection includes *Eubacterium*.

16. The process of claim 12 wherein the infection includes *Prevotella*.

17. The process of claim 12 wherein the infection includes *Lactobacillus*.

18. The process of claim 12 wherein the infection includes *Streptococcus*.

19. The process of claim 12 wherein the infection includes *Bacteroides*.

20. The process of claim 12 wherein the infection includes *Enterococcus*

21. The process of claim 12 wherein the infection includes Actinomyces.

22. The process of claim 12 wherein the infection includes

Propionibacterium.